


Contribution of Project-based Learning and Integrated Learning to Develop Student' HOTS

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Abstract: The development of higher-order thinking skills requires appropriate learning techniques. Project-based learning and integrated learning are learning models that can be used for this purpose. This study aimed to evaluate the contribution of project-based learning and integrated learning to the HOTS development of students in 6 private schools. The sample in this study was high school-level students who were determined by purposive sampling and random sampling techniques. The number of samples is 500 students. The instruments used are a measurement scale and a questionnaire with open questions. Data analysis was performed using the partial least squares technique. Based on the results of measurement scale data analysis, it was found that project-based learning combined with integrated learning showed a significant contribution to the development of students' HOTS. Project-based learning and integrated learning provide flexibility for students to study according to their characteristics so that the application of the student-center approach is practical. In addition, students are more motivated to undergo the learning process with this model approach because of the challenges of producing quality projects.

Keywords: HOTS, Project-based Learning, Integrated Learning

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Introduction

Developing students' thinking skills is one of the essential goals in the educational process. According to Marzano and friends, thinking skills have levels/levels starting from simple thinking skills (LOTS) to complex thinking skills (HOTS). The learning method or model widely used by teachers in Indonesia develops lower-order thinking skills; only a few teachers used learning models that develop students' higher-order thinking skills. The results of the PISA and TIMSS tests placed Indonesia in a below-average rating as a result of this problem.

Teachers are responsible for designing and implementing excellent and appropriate learning to develop students' higher-order thinking skills. Teachers use many learning methods or approaches in the learning process, but not all of these methods can train and develop students' thinking skills into higher-order thinking skills. It was found

that project-based learning can develop students' thinking skills (...). Through the Ministry of Education, the Indonesian government launched a curriculum revision called the Merdeka Curriculum. In this curriculum, all schools in Indonesia must carry out project-based learning. The aim is to develop the character of Pancasila while at the same time developing students' higher-order thinking skills. Several private schools have implemented a combined learning model between project-based and integrated learning. This study aims to examine the contribution of the combined learning model of project-based and integrated learning in developing students' thinking skills in these private schools.

Higher Oder Thinking Skills

Higher-order thinking skills (HOTS) are skills in using complex cognitive powers. Lewis and Smith (1993, 136) define HOTS as thinking that occurs when a person retrieves new information stored in memory and interrelated or rearranges and expands this information to achieve a goal or find possible answers in a confusing situation. Brookhart (2012, 3-8) defines higher-order thinking skills (HOTS) into three categories, namely 1) transfer, 2) critical thinking, and 3) problem-solving. According to Brookhart, in the transfer process, it is indicated that meaningful learning occurs, meaning that it can give meaning to the learning material. The definition of critical thinking contains the notion of being able to make an assessment or produce critical thinking (criticism) that has a basis or reason based on the results of reflection and makes a choice/decision. Meanwhile, the definition of HOTS in problem-solving is thinking to solve problems and produce new solutions. Schraw, McCrudden, Lehman, and Hoffman (2011, 21) explain that the definition of thinking ability contains various cognitive abilities. Several factors influence the development of higher-order thinking skills in students. In the curriculum, the learning approach used is the thematic approach and the subject approach. Thematic approaches can support the development of HOTS (Zohar, 1994; Madhuri, 2011). An essential factor in the implementation HOTS-Based curriculum is the quality of teachers in higher-order thinking skills. Teachers who have mastered and applied higher-order thinking skills will develop these skills for their students (Hassan, 2017; Row, 2016; Saido, 2015).

Project-based Learning

Project-based learning (PjBL) is a learning model that schools can implement. In this model, students are trained to solve local problems. According to Chard in Drake and Burns (2004), project-based learning planning includes three stages, namely: 1) selecting topics to be studied based on interests, curriculum standards, and local sources; 2) the teacher explores the knowledge students already have and helps them to make exploratory questions, provides resources, and opportunities to go into the field; 3) students share their work with their friends, report their work, and evaluate their work. In project activities, students learn to make connections between knowledge and apply knowledge to solve real-life problems (Curtis, 2002).

Project-based learning aims to help students to explore knowledge as well as apply this knowledge in a tangible form, namely the results of the project. The processes carried out by students in project-based learning based on

practice in schools are literacy, planning project activities, implementing projects, and reporting or presenting project results. Through this learning activity, students are trained to apply simple research steps. These steps start from extracting information about knowledge following the objectives to be achieved through project activities. In the next step, they practice planning the process to be carried out, from preparation to getting results. After that, they started implementing the plans that had been made until they finally achieved the project results. Project results can be in the form of goods or new concepts from solving problems on issues worked on in project activities. Through project activities, students are given real experience solving social or environmental problems. It is essential for students. Students practice analyzing, evaluating, and creatively creating something helpful/meaningful to achieve the results set at the project's beginning. Problem-solving, communicating, collaborating, and decision-making skills are developed in the project implementation process. Through project learning activities, they are also trained to sharpen their sensitivity to social issues and natural environmental issues around them. In addition, through project activities, students' character can develop because they deal directly with real-life experiences.

Integrated Learning

Integrated learning (IL) is a learning model that aims to help students develop a holistic way of thinking. According to Drake & Burns (2004), the definition of integrated learning can be seen from three different points of view. The three viewpoints provide three definitions based on the integrated learning approach category. The first approach is multidisciplinary integration, the primary approach to scientific disciplines. Integration occurs through one particular theme. The second approach is interdisciplinary integration through general learning across disciplines; for example, students learn about water when learning/practicing reading skills. The third approach is transdisciplinary integrated, which is an approach in which the teacher organizes the curriculum around student concerns and questions (Drake & Burns, 2004). Integrated transdisciplinary is carried out in the form of project-based learning.

Learning combines several subjects through a particular theme (thematic) or learning about a matter/problem from various knowledge angles. Through integrated learning, students are trained to think as a whole, not compartmentalized, and broaden their perspective on various things that happen in life. In integrated learning, students practice studying an object or event from various points of view. Integrated learning begins by raising a problem or giving specific issues to students. They are guided to analyze and criticize these issues from various perspectives based on the existing field of study at the senior high school level. The ability to analyze and criticize these issues will help them find solutions or determine their alignment.

Method

This study evaluates the contribution of project-based learning and integrated learning models to the HOTS development of students. This study uses a convergent-parallel design approach from mixed methods.

Respondents in the quantitative research were high school students in six private high schools. Following the research objective, namely evaluating the contribution of the learning model implemented in several private schools, the school selection technique was purposive sampling, while the determination of students as samples were carried out by random sampling technique. The sample in the study amounted to 500 students. Respondents in the qualitative research were the teachers who taught at the six schools and their students. Teachers who answered the questionnaire with open questions totaled 50 teachers. Students who gave answers to questionnaires with open questions totaled 100 students. The instrument used in quantitative research is a Likert measurement scale of 1 to 8 to explore information about project-based learning and integrated learning. Test the ability to dig up information about students' skills in higher-order thinking skills. Meanwhile, the qualitative research instrument was an open questionnaire to teachers about their students' HOTS developments, . For testing the instrument's feasibility, the researcher conducted instrument testing: reliability test, validity test using factor analysis, and differential power test. The following are the results of instrument testing.

Table 1. Reliability Instrument

Variables	Result	
HOTS	Spearman-Brown Coefficient	.947
	Guttman Split-Half Coefficient	.947
Method (PBL & IL)	Spearman-Brown Coefficient	.920
	Guttman Split-Half Coefficient	.919

Instrument reliability was measured using the Spearman-Brown split-half method. Based on the measurement results in Table 1, the instrument has fulfilled the reliability test requirements with a value of $r > 0.70$.

Table 2. Validity Instrument

Variables	Result		
HOTS	Kaiser-Meyer-Olkin	Measure of	.956
	Sampling Adequacy.		
	Sig.		.000
Method (PBL & IL)	Kaiser-Meyer-Olkin	Measure of	.945
	Sampling Adequacy.		
	Sig.		.000

Testing the instrument's validity uses factor analysis to test the strength of the indicators in representing the construct. Based on the test results, as shown in Table 2, the KMO-Bartlett value > 0.60 . These Five items from the HOTS variable were discarded from the differential power test results because the differential power values were below 0.3. In comparison, 21 items were used because the differential power values met the requirements. At the same time, the method variable shows the different power results of all items that have met the requirements.

results indicate that the validity requirements have been met.

Table 3. Discriminant Test

Variables	Discriminating Power	
HOTS	H1, H3, H4, H5, H6	Poor
	H2, H7 – H26	Good
Method (PBL & IL)	M1 – M18	Good

A partial-least square is used to analyze data. PLS analysis includes two stages/steps of model testing: testing the measurement or external models and testing the structural or internal models. Testing the measurement model is carried out to test the validity & reliability of the model, while testing the structural model is testing the relationship between the independent and dependent latent variables. The measurement model testing phase has been described above. The testing phase of the structural model (inner model) is carried out to test the significance of the contribution of the exogenous variables to the endogenous variables. Structural model testing assesses the relationship between latent variables (Ghozali, 2014, p. 73). The results of structural model testing are seen from the R-square, f-square, Q-square, and path coefficient values (direct effect, indirect effect, total effect). The R-square value explains the contribution of exogenous to endogenous latent variables. If the value of $R^2 > 0.67$ indicates a robust contribution/model; $R^2 < 0.30$ moderate contribution/model; and $R^2 < 0.19$ contribution/weak model (Chin, 1988). The f^2 value is used to assess the strength of the influence with f^2 criteria > 0.02 weak influence, > 0.15 moderate influence, and > 0.35 strong influence (Sarwono & Narimawati, 2015, p. 24). The Q^2 value is used to prove whether or not the reconstruction of the observed values is good. The criteria for seeing the relevance of predictions are the value of $Q^2 > 0$: the model has predictive relevance, and $Q^2 < 0$: the model has less predictive relevance. The following criterion used to analyze the results of the structural model test is the t-value provided that t-count > 1.65 (α : 10%), t-count > 1.96 (α : 5%), t-count > 2.58 (α : 1%) (Ghozali, 2014, pp. 78-81).

Results

The following is the result of data processing to test the construct validity, discriminant validity, and measurement model reliability of this research model. The following model image shows the loading factor values of the items in the variable.

From the model image, the loading factor value of all items in each variable is more than 0.50, so it can be said that all items meet the requirements as indicators for their respective constructs.

Table 4 shows that Cronbach's alpha and composite reliability values of the three variables have met the reliability requirements with test results greater than 0.70, while the AVE value is more significant than 0.50.

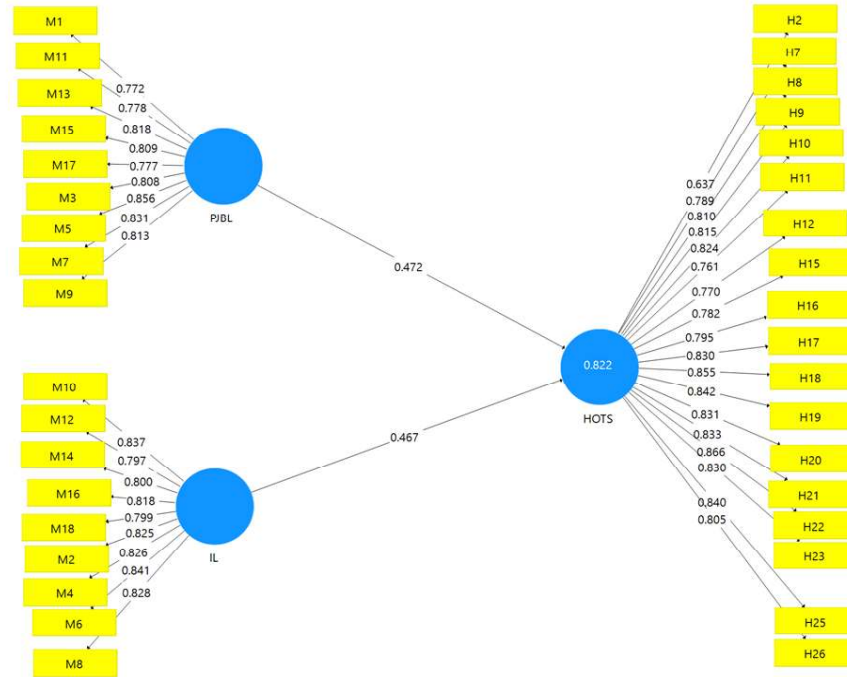


Figure 1. Loading Factor

Table 4. Reliability and Validity Test Results

Variables	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
HOTS	0.968	0.969	0.971	0.653
PJBL	0.939	0.939	0.948	0.671
IL	0.933	0.935	0.944	0.652

Table 5. Discriminant Validity: Fornell-Larcker Criterion

Variables	HOTS	PJBL	IL
HOTS	0.808		
PJBL	0.876	0.819	
IL	0.876	0.866	0.807

From the results of testing the validity of discrimination with the Fornell-Larcker criteria, the result is less than 0.90. Likewise, the loading-factor results show that all indicators of each construct have a more excellent loading-factor value for its construct compared to the loading-factor value for the other constructs. It shows that the set of indicators for each construct can explain each construct well.

Based on the results of the Fornell-Larcker discriminant validity test and the loading factor, it can be concluded that the outer model meets the requirements for discriminant validity.

Table 6. Cross Loading Factor

	HOTS	IL	PJBL
H10	0.824	0.767	0.702
H11	0.761	0.615	0.671
H12	0.770	0.691	0.635
H15	0.782	0.679	0.751
H16	0.795	0.754	0.676
H17	0.830	0.689	0.743
H18	0.855	0.769	0.703
H19	0.842	0.717	0.792
H2	0.637	0.548	0.553
H20	0.831	0.777	0.692
H21	0.833	0.702	0.753
H22	0.866	0.742	0.755
H23	0.830	0.677	0.707
H25	0.840	0.690	0.738
H26	0.805	0.740	0.673
H7	0.789	0.675	0.726
H8	0.810	0.781	0.705
H9	0.815	0.686	0.738
M1	0.614	0.629	0.772
M3	0.666	0.714	0.808
M5	0.757	0.742	0.856
M7	0.700	0.737	0.831
M9	0.748	0.707	0.813
M11	0.703	0.676	0.778
M13	0.760	0.711	0.818
M15	0.719	0.690	0.809
M17	0.680	0.681	0.777
M2	0.698	0.825	0.723
M4	0.691	0.826	0.719
M6	0.732	0.841	0.742
M8	0.694	0.828	0.713
M10	0.756	0.837	0.728
M12	0.725	0.797	0.688
M14	0.740	0.800	0.698
M16	0.720	0.818	0.707
M18	0.691	0.799	0.667

The cross-loading factor values shown in the table show that all items in each construct show a higher value compared to the loading factor values in the other constructs. From the Fornell-Larcker value and cross-loading, discriminant validity has been met.

Structural Model

The model's structural testing results are seen from the R-square, f-square, and Q-square values.

Table 7. R-square

	R Square	R Square Adjusted
HOTS	0.822	0.821

The R Square value indicates the joint or simultaneous effect of PBL and IL on HOTS of 0.822 with an adjusted R-square value of 0.821. Thus, it can be explained that all exogenous constructs simultaneously affect the endogenous construct by 0.821. Because the Adjusted R Square is more than 0.67, the effect of all exogenous PBL and IL constructs on HOTS is strong.

Tabel 8. F-square

	HOTS	IL	PBL
HOTS			
IL	0.305		
PJBL	0.312		

Based on the table of F-Square values above, which has a significant effect size with F-Square criteria > 0.35 is not there. While those that have a moderate effect, namely with F Square between 15 to 0.35, are the effects of IL and PBL on HOTS.

Tabel 8. Q-square

	SSO	SSE	Q² (=1-SSE/SSO)
HOTS	9000.000	4209.286	0.532
IL	4500.000	4500.000	
PJBL	4500.000	4500.000	

Q-square value > 0 indicates the model has predictive relevance; conversely, if the Q-Square value ≤ 0 indicates the model has less predictive relevance. The Q-square value in the model shows a value of $0.532 > 0$, so the model has predictive relevance. The results of the analysis of the direct effects inner model in the table below.

Based on the results of the analysis of the direct effects inner model in the picture above, it can be concluded as

follows: The direct effect of IL on HOTS is 0.467, which means that if IL increases by one unit, HOTS can increase by 46.7%. This influence is positive. The direct effect of PBL on HOTS is 0.472, which means that if PBL increases by one unit, HOTS can increase by 47.2 %. This influence is positive.

Table 9. Path Coefficients

	HOTS	IL	PBL
HOTS			
IL	0.467		
PBL	0.472		

Table 10. Path Coefficients

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
IL -> HOTS	0.467	0.468	0.041	11.483	0.000
PJBL -> HOTS	0.472	0.471	0.041	11.414	0.000

The table above shows the t-value > 1,960, and the p-value is 0,000. So, the PBL and IL learning models each contribute positively to the HOTS development of students.

The learning carried out in the six schools in this study applies the transdisciplinary learning model of integrated learning through project-based learning. There are two ways to do in preparing the project. The first way the teacher determines the theme is according to the issues currently developing in each school's local community. Students are asked to determine the project according to their understanding of the theme. The second way, the teacher determines the project in the form of results or products expected from project activities. Students explore a variety of knowledge to prepare the project implementation process to produce the specified product or result. Based on the implementation of project-based learning, teachers and students responded to open questions about how much the students' abilities in higher-order thinking skills, communicating, and collaborating increased, the constraints experienced in the combined model of project-based learning and integrated learning, and the advantages of this learning model.

In an open-ended questionnaire, the teachers responded about how much the students' abilities in higher-order thinking had developed, including analytical, evaluation, and creative thinking abilities through IL and PBL learning. They gave answers based on data on the value of learning outcomes. From these questions, they said that above 75% of students experienced good development in their ability to do analysis, 60% experienced good development in criticizing a problem or issue, and 65% of students showed progress in creating or providing solutions to a problem. In solving problems, 70% of students can provide creative and appropriate solutions. 60 to 75% of students experience positive developments regarding communicating and collaborating.

The constraints teachers face in the combined learning process of project-based learning and integrated learning are summarized in three categories: 1) time constraints for project activities due to limited time allotted for project activities; 2) constraints from limited facilities and infrastructure at school, such as yards to carry out eco-enzyme projects, waste recycling processing, limited wifi facilities to dig up resources from websites, no land for gardening or animal husbandry; 3) constraints in integrating the competencies of certain subjects involved in the project; 4) constraints in providing individual student assessment of project activities. Teachers need intense training to design project learning models combined with integrated learning. Based on the answers, students, based on the order of the highest number of answers about obstacles they experience through the PBL-IL learning model: 1) greater demands from the project, 2) not being able to manage time properly so that assignments become overlapping, 3) misunderstandings in communicating in groups, 4) problems with friends who do not want to work, 5) inadequate school facilities to work on projects, 6) make decisions to be able to combine various ideas in the group, 6) many ideas come up so you have to be able to choose or combine these ideas and this takes time.

The advantages or advantages of the PBL - IL combination learning model are summarized in three categories. 1) Students experience progress in thinking skills. They show progress in their analytical, problem-solving, and creative abilities. It can be seen from the results of the reported project work. 2) Students experience development in the ability to cooperate/collaborate and communicate. Situations that require them to work together on projects encourage students to learn to communicate with different friends. 3) Learning is more interesting because it can be seen from students' enthusiasm for project activities. Students are enthusiastic because they are driven to make the best project results. While the advantages of this learning model based on the results of the answers of the students who have been sorted from the highest number of answers are: 1) learning is more exciting and not dull, 2) it trains independence and communication, 3) it can work with different friends so that they know more friends than before, 4) be more creative, 5) broaden horizons through collaborative activities, 6) learn to make decisions to combine various ideas in groups, 7) learn is more exciting and not dull, so it is more enthusiastic in learning.

Discussion

The research data shows that the path coefficient value between the PBL learning model and the HOTS development of students is more significant than 1,960, with a p-value of 0,000, meaning there is a positive relationship. PBL is a learning model that makes students actively involved in the learning process. It can be seen from the steps of PBL activities, which begin with extracting subject matter/information to carry out the project, designing a project implementation plan to achieve the expected results, and planning implementation, namely starting to carry out project activities to produce the expected product. Students are required to carry out these steps independently with the help/guidance of the teacher. These steps illustrate how students are required to work and be active in the entire learning process until the requested product is obtained. In addition, in carrying out these steps, students must carry out analytical, evaluation, and creative thinking processes. This

thinking process is a high-level thinking process, as Marzano and Kendall (2007) explained in the New Taxonomy. Project-based learning provide flexibility for students to study according to their characteristics so that the application of the student-center approach is practical. In addition, students are more motivated to undergo the learning process with this model approach because of the challenges of producing quality projects.

The research data shows that the path coefficient value between the IL learning model and the HOTS development of students is more significant than 1,960, with a p-value of 0,000, meaning there is a positive relationship. Integrated learning combines various scientific fields to discuss a particular issue or problem. At school, the teachers use specific themes to discuss in an integrated manner. It aims to accustom students to look at things from all points of view so that they can assess them objectively. According to the teachers, students still need to be trained to see things as a whole because they are still used to separate learning. Based on the learning assessment results using the IL model, students showed broad analytical abilities in terms of insight compared to when they analyzed problems in one subject area. IL learning enables students to be creative more freely, demonstrated through IL learning works or products, such as school magazines, wall magazines, and other works. Integrated learning provide flexibility for students to study according to their characteristics so that the application of the student-center approach is practical.

The combined learning model between project-based learning and integrated learning is one of the models that teachers can use to develop students' self. The findings clearly show that the PBL – IL learning model encourages the development of students' thinking skills to a high level (Affandi & Sukyadi, 2016; Botha, 2010; Costa-Silva et al., 2018; Cudney & Kanigolla, 2014; Dzan et al., 2013; Mou, 2019; Rodríguez et al., 2015). One of the obstacles that arise is the problem of misunderstanding in communicating, but this problem is a means for students to practice communicating so that they experience progress in communication skills and organizing activities (Indrawan et al., 2018; Goldstein, 2016). Other soft skills that develop through the PBL – IL learning model are decision-making skills. From the project work process, students learn to combine ideas that arise in groups. The emergence of various ideas or ideas to work on projects is a challenge for students. Through this challenge, they learn to combine these ideas creatively or make decisions to determine which ideas to choose and use in their projects. From this, it can be seen that through the obstacles they face in the PBL-IL learning process, students hone their skills, such as the ability to analyze, evaluate, and make decisions, and be creative in order to be able to complete projects and produce whatever products or results they want—demanded from the activity. Problems in communicating help them find the right way to communicate to complete the task correctly. Another advantage of the PBL-IL model is that students' learning motivation is better than if the teacher uses the usual learning model in class.

The obstacle in developing IL learning experienced by teachers is the demand to find exciting and challenging student themes. The problem of collaboration between teachers in learning IL is a separate issue, some teachers are open to collaborating in the IL learning process, but some teachers need to be more open; this will be an obstacle in efforts to implement IL in schools. The problem that needs to be considered in the learning process is that teachers are required to be creative in finding specific themes or projects that can be a means for students to

learn about the integration of scientific disciplines - such as the integration of social and natural science disciplines - which is possible to do in schools. Limited facilities are also a significant obstacle for teachers in the PBL-IL learning process. This problem also encourages teachers to be creative in finding what projects can be carried out at school while accommodating a quality PBL learning process.

Based on the findings above, through the PBL-IL learning model, students and teachers experience development through preparing and implementing integrated project learning and through efforts to overcome the obstacles encountered.

Conclusion

Project-based learning and integrated learning are learning models that positively contribute to developing students' higher-order thinking skills. Therefore, it would be terrific if teachers could use these two learning models more often to develop students' HOTS. In addition, these two learning models can be a means to develop skills in communicating and collaborating. Project-based learning and integrated learning provide flexibility for students to study according to their characteristics so that the application of the student-center approach is practical. In addition, students are more motivated to undergo the learning process with this model approach because of the challenges of producing quality projects.

The limitations in using project-based and integrated learning models are mainly the willingness to be active and collaborate. It is an obstacle for some students because they are used to learning individually. This model is less attractive for some teachers because it requires them to work with other teachers while they feel free to complete the learning process individually.

Recommendations

Recommendations for further research are that it is necessary to explore qualitative research by observing the project implementation process to obtain a broader picture of PBL and IL.

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